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The United States Armed Forces Institute Field Examination in High School Biology

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Although the average educational level of the men and women of the Armed Forces is higher than that of the soldiers in the last World War, a large number have not been graduated from high school. Few, if any, of these people will ever return to high school, but many will want to secure a high school diploma. Some will want this certificate only as evidence of educational attainment because such a credential not only possesses prestige value but also may be useful to them in procuring jobs. Others will want to use this diploma for securing admission to the nation's colleges and universities.

An article in the November issue of this Journal quoted from Dr. Ralph W. Tyler's article on the *Appraisal of Military Training and Experience.** In this he describes the United States Armed Forces Institute Program and its relation to the opportunities which men and women in the Armed Forces are having for securing educational development. A large number are securing some type of technical training in connection with their branch of the service; many are taking advantage of the college and university correspondence courses which are made available to them through the Institute as well as courses offered directly by the Institute; others are enrolling in the class instruction offered in the off-duty educational program which both the Army and Navy are sponsoring; finally, most of the members of the Armed Forces are profiting greatly from the informal educational experiences of military life, by finding that their experi-

* Tyler, Ralph W., Appraisal of Military Training and Experience, *Journal of American Association of Collegiate Registrars*, pp. 345–352, July 1943. Dr. Tyler is Director of the Examinations Staff of the United States Armed Forces Institute.

ences in camp, in combat, and during occupation of foreign lands are proving extremely informative. These formal and informal training experiences may often educate the soldier as well as would classroom instruction. Many returning soldiers will have acquired knowledge and abilities for which most schools would be willing to grant credit. The men and women of the Armed Forces will be given an opportunity to demonstrate their competence and to receive appropriate high school or college credit for it. Rather than give blanket credit for military experience as was done by many institutions in the last war, it has been decided that the soldier's educational attainment can best be appraised by the use of comprehensive examinations. These examinations are prepared by the Examinations Staff of the United States Armed Forces Institute, and while many of these examinations have already been completed, many are now being prepared.

Types of Examinations

A returning soldier may elect to take any of the comprehensive examinations or "field examinations" as they are called by the United States Armed Forces Institute. It is not necessary for the soldier to have had any formal instruction in this area and his former status as a student is of no importance. For example, in the high school science area, he will be able to take examinations in general science, biology, senior science, chemistry, and physics. After taking an examination, he may have his records sent to his high school principal who will decide whether the school wishes to grant this soldier credit toward graduation. While the examinations administered by the Armed Forces will be secret forms, comparable forms of these tests will be available through the American Council on Education. These examinations will undoubtedly be used by many schools and particularly by those who anticipate granting credit to their returning former students. By administering these comparable forms, the teachers and principals can discover how well their own students perform on the United States Armed Forces Institute examinations, and in that way they can better determine what level of achievement a soldier must demonstrate before he should be granted credit. It should be noted that while general norms are to be supplied by the Institute, the school itself must decide whether it wants to use the passing and failing recommendations of the Institute or select critical scores by administering the test to its own students.

In addition to the field or accreditation examinations in biology, chemistry, physics, and so on, end-of-course tests have been prepared for the Institute courses. These tests are given at the completion of the Institute courses and while they are not in general intended for accreditation, some schools already have elected to use them for that purpose.

There is still another battery of examinations with which the science teacher and the administrator should be familiar. This is the General Educational Development battery. These tests cover broader areas. For example, the only high school science test in this battery is one titled Interpretation of Reading Materials in the Natural Sciences at the High School Level. It is not intended that this test should be taken by soldiers who wish credit in any specific course. Instead, it is primarily a placement test by means of which, for example, the soldier can demonstrate his ability to read science materials critically and with understanding. A record of this general

competence is useful to the soldier who wishes to apply for admission at some college or university and desires to acquaint the school with the level of work he is capable of handling. It is true that some high schools may wish to use the scores from the General Educational Development Tests for granting high school diplomas, but ordinarily, the school which is about to grant a diploma will want the soldier to demonstrate proficiency in certain specific courses in which he now has a deficiency.

The Biology Examinations

A number of things had to be considered in preparing the field or accreditation tests. In the first place, the tens of thousands of men and women who will take the biology test will come from a variety of service branches. Many of them will have worked with the medical corps, with sanitation engineers, with supplies, with cooking, and in any number of other jobs. Some will have learned a great deal of technical information in some specific field, while all will have learned a great deal about many practical problems associated with physiology, health, hygiene, foods, first-aid, and conservation. If the soldier is to be given credit toward graduation, it is important that school standards be upheld. However, if the soldier is to be given an opportunity to demonstrate his competence and if he is not to be penalized for his lack of formal and recent training, then it is important that our methods of evaluation be considered very carefully. Some of the things which were considered in the case of the Field Test in High School Biology were:

1. That the test scores be in such a form that they can be interpreted easily by schools which offer different types of courses.
2. That the level of difficulty of the items be characteristic of the work encountered at the 10th and 11th grade levels.
3. That the settings for application items be interesting to an adult and at the same time be as interesting and functional as possible for the 10th and 11th grade students.
4. That the items in the test sample widely from material found in current, popular literature.
5. That the test not penalize a student for lacking that type of information which he might have possessed only had he had very recently a classroom and laboratory course.

In view of these requirements for an evaluation instrument, it is probably surprising that none of the standardized tests proved suitable. In planning the test in biology, we consulted teachers and people in administrative positions in an effort to become more familiar with reasonable methods for handling the evaluation problem. Some of the specialists who were chosen as professional consultants on this examination were selected on the basis of their work in high school science methodology, experience in high school biology teaching, and understanding of present-day trends in high school biology objectives. The literature was searched for studies dealing with the expressed aims and objectives of high school biology courses, for studies showing the agreement between various courses of study, for studies showing the agreement between various textbooks, and for studies evaluating the amount of biological information found in popular literature. In addition to this, nine of the best standardized tests were examined critically and eight of the most widely used textbooks were also examined critically.

As a result of consultations, surveys of the literature, analysis of tests and textbooks, the following appeared to be the major objectives and aims of a high school biology course:

1. That the student acquire a fund of fac-

tual information about animals and plants. This includes
   a. a functional technical vocabulary.
   b. a knowledge of specific facts.
   c. a knowledge of simple relationships.
   d. a knowledge of simple numerical constants which are often encountered.
2. That the student acquire an understanding of certain important principles. This includes
   a. the ability to apply principles in new situations.
   b. the ability to make qualitative and quantitative evaluations in problems involving these principles.
3. That the student acquire an ability to use the scientific method. This includes
   a. the ability to reason by induction and deduction.
   b. the ability to withhold judgment and to change opinions as a result of new and adequate factual evidence.
   c. the recognition of fallacy in common superstitions and practices resulting from ignorance.
   d. the ability to make critical judgments in evaluating the data from an experiment.
   e. the understanding of the cause-and-effect relationships.
   f. the ability to formulate workable hypotheses.
   g. the ability to devise experimental methods for formulating hypotheses.
4. That the student acquire a skill in locating and collecting source materials helpful in the study of biology.
5. That the student acquire an ability to read, understand, and evaluate articles of a scientific nature appearing in popular literature.
6. That the student acquire those skills associated with the collection and preservation of specimens.
7. That the student acquire a skill in the use of those tools and instruments used in the study of biology, *e.g.*, microscope, dissection instruments, etc.
8. That the student acquire an understanding of the importance and significance of biology, physiology, health, hygiene, conservation, and consumer education for the layman.

It is important that this United States Armed Forces Institute examination take as many of these aims and objectives into account as possible. In view of the fact that schools and teachers place different emphasis upon these points, it would be useful and desirable if the test could be so constructed that part-scores be made available on at least some of these objectives. It would not be practical to include sections on each of these objectives, for a profile including many part-scores becomes very cumbersome. As a compromise, the objectives were classified under a minimum of headings. These are:

A. That the student acquire a fund of factual information. (This includes the items listed under Objective 1 on page 6.)
B. That the student acquire an understanding of certain important principles. (This includes the items listed under Objective 2 on page 6.)
C. That the student acquire an ability to use the scientific method, to propose hypotheses, to plan experiments, etc. (This includes the items listed under Objectives 3, 4, and 5, on page 7.)

In this method of classification, no attention has been given to Objectives 6, 7, and 8, because these three objectives ordinarily emphasize those manual skills which are difficult to measure by means of a paper and pencil test. These objectives are not being entirely omitted from this test, however, for some questions relative to the names of preservatives, principles of optics, and consumer problems can be included under headings A, B, and C.

The examination, therefore, is divided into three "ability objectives." More-

over, it was decided that by dividing the examination subject matter, it would be easier to plan items. The accompanying diagram illustrates an ability and subject matter classification that is being used at the present time. Some changes may be made in these classifications by the time the examination is complete.

It is thought that the break-downs which have been employed will, in general, be more useful to the majority of schools than any other kind of division. Each of the three subject matter areas listed in the examination plan includes (1) animal biology, (2) plant biology, and (3) human biology. If there are schools which would prefer part-scores on animal biology, plant biology, and human biology, or any other classification, it would be relatively simple to prepare the scoring keys needed for such a break-down of scores.

The above diagram of a test plan describes, in general, the manner in which many of the United States Armed Forces Institute tests are planned, although, of course, the classifications of ability aims, as well as subject matter areas, vary from test to test. In some United States Armed Forces Institute tests, part-scores are made available on the basis of both subject matter divisions and ability objectives, but no part-scores are obtained from individual cells of the pattern. After selecting a tentative plan for constructing the test, we proceeded to list specific subject matter aims, expressing each in terms of one of the ability-type objectives. These were then classified according to their proper cell or, in other words, according to its subject area and the ability with which it was associated.

PLAN FOR BIOLOGY EXAMINATION

Subject Matter Areas \ Ability Objectives	A Knowledge of Facts, Vocabulary, etc.	B Understanding of Principles	C Ability to Use Scientific Method
I. Structure and physiology of living organisms	I–A	I–B	I–C
II. Health, hygiene, foods, conservation, and the interdependence of living organisms	II–A	II–B	II–C
III. Genetics, heredity, evolution, and plant and animal breeding	III–A	III–B	III–C

In the case of some concepts, terms associated with the principles were included in "A," application of the principle included in "B," and the same principle used as a basis for a problem involving the scientific method under "C."

A few of the objectives and their classifications are listed below:

I–A. That the student acquire the ability to define such terms as "calories," "carbohydrate," "catalyst."

I–B. That the student acquire an understanding of how a phototropic insect will react to light under certain conditions.

I–C. That the student acquire an ability to draw conclusions from data selected from experiments, *e.g.*, one of Koch's experiments.

II–A. That the student acquire a knowledge

of what specific ailments are associated with vitamin deficiencies.

II–B. That the student acquire an understanding of various methods of soil conservation.

II–C. That the student acquire a knowledge of what sources he can use to best advantage in finding material.

III–A. That the student acquire an ability to define such terms as "gene," etc.

III–B. That the student acquire the ability to predict from adequate data the proportion of off-spring having given characteristics.

III–C. That the student acquire the ability to discover the fallacy in statements which are based on an experiment dealing with certain cause-and-effect relationships.

Items were prepared for each of the objectives. The number of items in each cell depends upon such factors as the adaptability of certain subject matter content to specific types of questions, the relative importance of certain ability objectives when applied to given subject areas, and so on.

Teachers of biology will be interested to know that some of the items commonly found in examinations will have been almost completely eliminated from this field examination. For example, it will include *very few* items which require the student

1. to name principles, processes, and phenomena which are not found in current, popular literature.
2. to name the scientists responsible for certain discoveries.
3. to specify the date upon which a certain discovery was made.
4. to remember technical terms which are not found in current, popular literature.

The items have been so constructed that they represent a wide range of difficulty. During the preparation of the items, they are examined critically by members of the staff, by informal consultants, and the professional consultants. In addition, students who have recently taken high school biology are asked to read the questions and to comment on their wording and difficulty. As a result of this type of critical analysis, some items are discarded and others are changed.

From this revised group of items, two forms of the test are prepared, care being taken that both forms sample the same proportion of items from each cell in the test plan. At this point, examinations will again be criticized by the consultants and additional alterations will be made in accord with their suggestions. The revised forms of the examination will then be tried out in high school biology classes in various parts of the country and some tryouts will also be administered to members of the Armed Forces. On the basis of all these tryouts, the individual items will then be statistically analyzed for difficulty and discriminatory values. As a result of this analysis, some items will be deleted because of their difficulty and because they fail to discriminate properly. Finally, from the remaining items, the two tests, Form A (secret form) and Form B (to be released by the American Council on Education), will be prepared.

When completed, each form of the examination will contain about two hundred items and about one hundred twenty minutes will be required for the administration. This time should be very ample as this is *not* a speed test. The examination will be prepared so that answer sheets may be used and these can either be scored by hand or by the electrical scoring machine. Tables of norms for both Form A and Form B will be available through the American Council on Education.

Conservation Series, Unit I

Seven Keys to Wildlife Conservation

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Seven of the many keys that can be used to solve the wildlife conservation problem deal with shelter, predation, room, highways, food, breeding stock and health. Are you teaching about these things as they affect the wildlife near you? If not, why not?

Shelter

Did you ever see a bald-headed man troubled with head lice? Did you ever see a rabbit in the middle of a raspberry patch? You don't see the head louse on the bald-headed man because it is not likely to be where there is no cover. You don't see the rabbit that may be in the raspberry patch, because the raspberries cover the rabbit. There are those in wildlife conservation and wildlife management who contend that if we could master the problem of cover, all the rest of the problems would vanish. There is plenty of evidence to support this.

The next time you take a walk in the country in the winter take notice of where you find the greatest number of tracks of the smaller game animals. Are there more rabbit tracks in the open than near a brush-covered fence-row, a weed-covered swale, a corn-shock-covered field or a tree-covered wooded area? If you walk down a fence-row, do you find more tracks along an electric fence, a plain wire fence, a brushy fence-row, a rail fence, a stone-walled-fence-row or a stump fence? Why do you think the differences that you observe really exist? What is the cause and effect relationship?

Ask your students to select hundred-foot lines through different kinds of environment and keep records of the evidence they can get of the presence of game five or ten feet on either side of the lines they select. Out of this experience, they should draw a few simple conclusions, which will probably be more significant to them and to their environment than many they would get from books.

Let's vary this study of cover or shelter to include evidence of the nature of the cover. What animals for example use as shelter the earth, grass, brush, snow, water, forests, logs, hollow trees and son on? What conditions exist in these different places? For example, how does the temperature, wind velocity, sunlight, dampness differ in the places studied? Don't look in a book to find what the temperature should be in a log. Use a thermometer in the log. Don't worry about being too specific about wind velocity; just hang a few silk threads in different places and note the windcurrents these indicate. In the meantime, explore every type of cover available for study. If you are not surprised at what you find, I will be surprised at you.

Don't confine your studies to those to be found on land. Extend them to the streams and waterways available for study, and there include data on the extent to which the environment moves. If convenient, add some data on any significant variation in the chemical con-

tent of the water. For example, is it hard, soft, salty, or brackish? Is it clear or turbid? Why do some waterways that have clear water yield more fish than some waterways whose waters are so turbid that photosynthetic activity is limited to a relatively shallow body of water at the surface? What are the essential shelters available for wildlife in a body of water?

It may seem strange that an article of this sort should be made so completely of questions, but any capable teacher should be able to get more content from answering the questions through personal investigation than could possibly be covered by a mere recital of facts that might not be at all pertinent in the reader's community.

Some consideration should be given to the management of shelters for wildlife in addition to recognizing the desirable types that exist. If wildlife is more abundant at the edges of clearings, then it can be understood why one group of wildlife managers suggests the making of clearings in cover so that there will be more borders. If cover is likely to be destroyed by fire or flood, then it is desirable that measures be taken to prevent these destructive agencies from doing their work. If the privacy of an area is interfered with so far as the needs of wildlife are concerned by wandering dogs, cattle or people, then it may be desirable that measures be taken to restrict the undesirable visits. If desirable cover is being destroyed by erosion or by sedimentation, then the biology teacher who wishes to teach about wildlife management and conservation must recognize the relationship at least and be prepared to point out the situation effectively to the land owners involved. Frequently, this calls for the highest form of diplomacy and teaching ability. Taking it all in all, it should be evident that the study of cover and shelter offers excellent opportunities for teaching effective biology.

Predation

A surprising number of high school teachers throughout the country have carried on "vermin campaigns" with the mistaken idea that in so doing they were furthering the cause of wildlife conservation. Stimulus in such campaigns has frequently been provided by prizes offered by ammunition companies or by local sportsmen's clubs.

The predation story carries with it need for combatting a tremendous amount of prejudice, with ability in reconcilling the laws of one state with those that may exist in adjacent states or countries and probably with many long established convictions that cannot be defended in the face of relatively recent discoveries. The study of predators offers an excellent example of how the scientific method of attacking a problem may yield results contrary to those produced by haphazard methods.

It is significant that while a decade ago much of the emphasis given game management at the national and state meetings of sportsmen used to center around predator control now most of this has vanished.

It is also significant that predator control is involved with many conflicting interests. A coyote pelt may have value as fur and the carcass may bring in a bounty. The live animal may be an enemy to sheep but few animals can compete with the coyote when it comes to keeping rodents in control, and rodents destroy a tremendous pasturage that might otherwise be used by domestic species of value to man. If we kill the coyote, we protect the lives of thousands of ground squirrels that eat tons of vegetation needed by cattle to provide food so scarce that it is rationed to us. What are we to do in a case like this? As

teachers we have a wonderful opportunity to teach people how to teach themselves. Our students can begin to examine critically the pellets regurgitated by owls, the scats left by foxes, skunks, coyotes and their kind. Possibly, what they find will help them educate the man who is too shiftless to do anything about the rats in his corn bin but literally up in arms and red in the face when he even thinks about hawks, weasels, skunks, foxes or owls that may be bent on the destruction of mice and rats that may literally eat him out of house and home and onto the relief roll. Here is a real (and ticklish) job for the biology teacher. It is worth fighting for.

In 1931, Eaton published an interesting survey of the results of the standard campaign against all hawks and owls. Over a six year period, it was found that the larger, more conspicuous and more useful species of hawks decreased 54 per cent in New Jersey where such campaigns were the practice. At the same time, the usually smaller and more harmful species increased 14 per cent. This was in part due to the fact that the removal of the larger forms reduced the natural competition for territory that the smaller more destructive forms had to meet, and left them a great abundance of common food taken by the whole group. In this way, the vermin campaign defeated the very function it was designed to fill.

The predator problem also involves the forming of judgments on the merits of species whose usefulness is on the borderline. Crows eat destructive insects as well as corn. What should we do about them? The fact that they seem to survive almost any campaign that man has devised has led some to say that campaigns that destroy the less wary crows are contributing to the development of a superior type bred from the more wary survivors. What do you think about this sort of argument?

If as a biology teacher you believe in giving emphasis to the identification of species, the predator story will give you much to do. Can you distinguish between a red-shouldered hawk and a red-tailed hawk when it is in flight? In my home state, it is legal for me to kill one and illegal to kill the other. Of course, I would kill neither but I doubt if most of the people who do kill either one of these useful birds know one from the other even after it has been killed, to say nothing of being able to identify it in flight or high on a perch.

No rational person will deny that most predators will, on occasion, kill useful species of game but this can be controlled by wise management. If a given species of hawk is prone to break up quail nests along a fence-row because the fence-post provides an ideal perch for the bird of prey, then a taller cover of brush along the fence will provide a less suitable perch for the hawk and a more suitable shelter for the quail. Incidentally, also, it will serve more satisfactorily in slowing down the winds that may otherwise remove loose, surface soil. This may also mean that less snow will blow away and the water that melts from that snow may remain to raise the water table and possibly lessen a drought the succeeding summer. Here is an example of how intricately interwoven are most of the things involved in wildlife management. In this paragraph, we started out with the relationship between hawks and nesting quail, and ended up with snow, the water table and drought. Surely, our practices in this field should be based on understanding, not on established rules of thumb. Medicine has gone beyond the stage where we select pink pills for pale people, and wildlife conservation has gone beyond the stage where we think that all hawks are hen-hawks, all weasels chicken killers, and all foxes our avowed enemies.

Room

One of the important keys to wildlife conservation admits us to consideration of the amount of space needed by important organisms if they are to be maintained in the desired numbers.

Fortunately, this lends itself well to activities for high school students. What is the maximum population of any given kind of organism that may be maintained in a given area? What is the optimum population for that area? What is the minimum population necessary if the species is not to be wiped out? What is the harvestable surplus on a given farm, in a given township, county or other area? What can be done to regulate the harvestable surplus for the good of all?

Probably, the study of territory or room should begin so far as high school students are concerned with the amount of territory normally used by some local creature. If a chickadee visits a neighborhood feeding station, then over how big a range does that individual bird feed? It may be difficult to tell one chickadee from another since they all look alike. This is not so difficult if the animal is marked with some distinguishing character. If a bird banding permit is held by the teacher or student, the bird may be marked by the use of dyes such as are to be found in any biology laboratory. It may be then watched and its home territory determined. It may be simpler to determine the individual range or territory of a snail or even of a butterfly. The snail may be marked on the shell with a dye and the butterfly may be dyed or a small hole may be punched in one wing with a paper punch the position of the hole or its shape being useful in the subsequent identification of the insect after it has been released. The use of dyes makes it possible to follow individuals without requiring their capture for identification purposes.

The simple studies of home range of common animals should be accompanied by studies on population counts. If the individual range of a given animal is known, then how many other animals of the same species live in harmony in the same territory and is this number the same throughout the year? For some reason or other, our biology books have told us more about the anatomy of a bird than about its habits. We may learn how many primary tail feathers a song sparrow has but nothing about the primary reason for a song sparrow's selection of a singing site. If we don't know much about this problem of territory for the individual, we cannot adequately understand the importance of room in wildlife management and conservation. Neither can we have any rational concept of what is a legitimate harvestable surplus on the home farm or in a larger area. In winter, some useful notes on territory may be had from records kept of tracks.

The essential factors that constitute the home range or territory of an organism should be recognized. There must be a territory where there is sufficient food. There must be an area where there is needed safety from the elements and from enemies and there must be safe passage between these two areas during the time when the creature is normally active. Look over the local territory of any organism and at least recognize these factors.

Look in your nearest trout stream for a food-producing area which usually is shallow water that is well aerated, and for a resting area that may be deep, cool and with hiding spots. A long stretch of stream of just one type of water is not likely to support so many trout as a

stream that has a maximum number of alternating resting, feeding and food-producing areas. Stream management is based largely on providing this maximum. Young folks who like to play in streams can do much to help produce superior conditions. Of course, the soil management story enters the picture here too but that is a story for a later unit of this series.

Many of our lakes and pools can support a rather high population of game fishes but provide no breeding areas. In such cases, the areas must be continually stocked if their production is to be maintained. Not infrequently, this artificial stocking is entirely efficient and an area need not be considered useless because it provides no breeding area, if breeding stock can be provided at an appropriate cost. This is particularly true in park ponds near large cities where it is desirable that a large number of people have the opportunity to have reasonable luck in fishing.

Some of the simplest significant studies on room that may be made in high school biology classes center around determining what the appropriate population is for an aquarium, terrarium or other artificially restricted unit. Apparently, this is not well understood by most people who attempt to maintain these units.

Highways

Some suggestion has already been made of the necessity of maintaining protected highways for game species in danger of being unable to maintain themselves. The tendency of many game species to move in flocks, schools and herds from one place to another often gives a distorted concept of their real abundance and this should be understood by a public too ready to jump to conclusions that seem to fit in with their own desires.

The protection of fly-ways for ducks, of resting places along the fly-ways has been significant in stimulating the return of a normal duck population. When the West was fenced and buffalo could no longer move freely north and south, the animals were doomed. When the breeding areas of elk were given protection but the winter feeding areas or access to these areas not protected, elk herds could not maintain themselves.

I wish that every high school could have one licensed bird bander or that some local bird-bander could be given the opportunity of meeting a biology class and telling of his experiences. For years, I banded birds until I accidentally killed a chickadee that had been coming to my traps for about three years. There is a real thrill in holding in your hand a bird bearing a band that tells you later that it came from some place a thousand miles or so away or that three or four years ago it was originally banded by a neighbor half a mile away.

And if we learn something from banding birds, then lets try the same technique on other species. I have one friend who marks turtles and who once strapped a spool of thread to a turtle's back so that it left a trail during its wanderings. Another friend bands frogs; another fish, and one even marks stones on a creek bottom to see how far they are moved in a year by the action of the current. Most of these studies or study methods could be followed by high school students and most of them should yield significant results. Certainly, they lead to the development of a rational attitude and appreciation of the value of the scientific method about which we hear so much, frequently from those who have no idea of what it means.

High school students can make significant studies on the movements of local animals. Local dogs probably have a more or less definitely established route they follow when they are free. Within

limits, we can get to know about when rabbits will run, fish will feed, racoons will be about, mice will come out of the closet and so on. Any youngster taught how to find these things out himself from the local animals will be better prepared to understand the reasons why we have certain game laws and may later be in position to help improve those that are in existence.

Probably, the most important observation here rests with that suggested earlier, namely that many species give a false impression of their abundance by their habit of forming great flocks at the time they may move from place to place. These flocks form the basis of judgments that help establish legal bag-limits. One of the ridiculous situations arising from this is found in the story of bag-limits for coots, rails and gallinules in New York State. In 1936, it was legal for any one of thousands of hunters in the state to take 1350 of these birds during the open season. All the hunters in the state combined took only 1046 of the birds. In spite of the fact that the take had dropped for the state from 8161 in 1921 to 1046 in 1936, the legal annual take per hunter was increased to 2530 in 1939. It might be stimulating for high school pupils to try to understand this sort of thing. I can't.

There is a rational solution of this story but it is not being put into practice now. Possibly, it may never be put into effect until our conservation departments of the various states are less dependent for their existenc on taxes collected from those who wish to kill larger numbers of game than their friends and neighbors. The establishment of private hunting grounds across the major fly-ways of game species, the establishment of private sanctuaries or hunting or fishing grounds where a select few may harvest animals reared elsewhere is in part a social science problem. But the basis of forming a rational conclusion lies also on an understanding of the movements of animals, which is a part of basic biology.

Food

The food problem is important in any activity directed toward the management of living things. This is just as true in dealing with wildlife as it is in dealing with horses, or human beings, or even of plants.

I once heard a man deplore the appearance of beavers in his favorite trout stream because he was sure the plant-eating beavers would eat up all of his trout. True, the beavers might affect his trout-fishing but it was not because of the food relationship he assumed. And knowing the man and the stream, I rather doubt that the variation would be in the direction he implied.

To some people, wildlife management is essentially that of carrying grain to snow-bound grouse and pheasants, or concentrated fodder to holed-in deer. I have no desire to decry the importance of these activities. The established practice of leaving a strip of grain along the fence-row for the wildlife that finds cover there is no doubt sound, and the planting of food species in areas inhabited by waterfowl is essential to an improvement of conditions, but this is not the only idea about food of wildlife that should be presented by the high school biology teacher. High school students should be informed on the food needs of local forms of wildlife and should make simple studies to determine whether those food needs are being met. They should recognize that there should be appropriate foods for creatures of different ages and that if an animal cannot make a seasonal adjustment, the food problem is more complicated than if such adjustment can be made.

Other angles of the food situation

hinge on the contribution wildlife can make directly to our food problems. If the game managers are right and wildlife is a crop, then it should be yielding an appropriate return in times when our own food supply is being rationed. This situation has led some people to urge letting down the bars on the intelligent harvest of wild animals useful as food and such a practice would of course be absurd.

We have unfounded prejudices against eating such animals as muskrats. It has been estimated that about 250 tons of such flesh is thrown away in New York State alone, the animals being taken for their fur only, though muskrat is reported to be served in Baltimore as diamond-back terrapin at six dollars a plate.

In considering wildlife and food, one must not overlook the role some game species play in the destruction of organisms that are the enemies of food plants. Sometimes, the only food-plant game relationship recognized is that the game animal may be destructive of the food plant. The Federal Land Planning Committee has recognized a commercial value to wildlife for the landowner and has set figures for the different parts of the country that recognize the value of different species as flesh and fur and also a value that they have as important destroyers of plant enemies. Both of these values should be considered in determining what should be done about local wildlife.

High school students who hunt or fish should make a practice of examining the stomachs of the animals they collect, not only so that they may be in position to harvest more game if this is desirable but also that they may understand the relationship of the animal killed to the agricultural economy of the area in which it lived. Some thirty years ago I stopped killing quail after I had made a careful examination of the stomach contents of some I had just killed on an Iowa farm. I had pulled too many weeds and sprayed too many potato plants in my youth to wish to destroy an animal that could do so effectively a job that was distasteful to me. On the other hand, I have repeatedly used the stomach contents of trout to provide me with a clue as to what was the appropriate food where I was fishing.

Some of the most intriguing studies have centered around producing, at low cost, insect foods suitable for young game birds that were to be raised in captivity as well as young fish raised in hatchery ponds. Flies and other insects that had apparently no value to man assumed a new importance in these studies just as the wastes from milk factories were found to have value in supplying organic food to insects that served as food for fishes. Any youngster who sets out to care for some wild pet and inquires into its suitable diet must of necessity progress in his biology work if he succeeds in keeping the animal healthy. With fur farming only in its infancy, and game farming hardly advanced that far, there should be some professional future for high school boys and girls who display interest and ability in this field.

Breeding Stock

The most sensible kind of wildlife management and conservation ordinarily calls for management that will permit the desired species to maintain their numbers with a minimum of expense and effort on man's part. True, in artificial areas near centers of human population, we may have something comparable to what we have in domestic animal husbandry. But raising rainbow trout in hatcheries and freeing them in streams where they may be caught next day, or rearing pheasants or Hungarian

grouse and driving them before hunters who sit comfortably in chairs in a shooting blind as is the case in England just does not fit into the picture most of have for America. Furthermore, it is not practical to depend on such a program over great areas where the human population is sparse.

Some of the important problems that may be considered by the high school student and integrated into the biology program by the biology teacher are the following:

What effect may be expected by the introduction of stock from a mild climate, and the interbreeding of this stock with stock acclimated to a severe climate?

How does the problem of harvesting a surplus vary in species in which the sex differences are conspicous as in pheasants and inconspicuous as in grouse?

What complications can be expected where heavy hunting reduces unduly the breeding males as is the case with deer in some eastern states?

How can a species be expected to reestablish itself if the population is so seriously reduced that suitable mates cannot be found when these are needed?

What is the best proportion of breeding males and females in different species if a maximum number of young are to be reared in a limited breeding area? How can the proper proportion best be maintained?

What provision is made to meet the special demands of young animals just hatched or born and what habits of the adult males help or interfere with a maximum number of young being born? For example, in the bob white, the cock bird may assist in the incubation and rearing of the young while in many of the ducks, this is not true. What difference does this make in the probable size of the family that may be reared and in the size of the breeding stock that must be left to begin a new year?

Health

Just as health is important in the solving of human problems so it is in affairs dealing with wildlife. It is tied up with practically all of the other ideas so far discussed in this article, but it also has independent importance.

Some of the organisms responsible for disease in wildlife are dangerous to man; the organism causing tularemia for example. If this disease becomes established in a given area it affects a variety of things. For example, should diseased rabbits be introduced into a fruit-growing region, they might easily become a serious pest because hunters would avoid taking them, and the normal increase might not then be harvested.

There is much discussion about what should be done during the periods when rabbits, grouse and other such species go through cycles of abundance. One school of thought has held that in such periods, heavy shooting should be encouraged since this will presumably remove diseased stock from the fields. How this practice can be controlled so as to remove only weakened individuals seems hard to understand, but the philosophy has been defended by many influential leaders.

The story of parasites, of the effect of ducks eating lead, of the effect of alkali on migrating species, of the fate of crippled individuals not killed by hunters, of migrants weakened and subsequently diseased because of oil wastes on their feathers, and of diseases peculiar to game raised in confinement, all offer a wealth of problems that must be solved if wildlife is to be maintained in maximum abundance.

THE SERIES OF CONSERVATION UNITS

There is a school of thought that contends all any student needs for success in a field of applied biology is a sound training in the basic sciences. No one would deny the value of this basic training. Yet, few will deny the existence of legitimate fields of education supplied by schools of medicine, of agriculture and even of nutrition. What applies to these fields might apply equally well to progress in the field of conservation and particularly of wildlife conservation.

In our high school courses, we do give entity to work in agriculture but usually basic work which might be significant in medicine, nutrition and bacteriology are incorporated as they should be in general courses in biology. There is, at present, a tendency in some states to take the health work out of biology and establish it in independent form or even to substitute work on health for the offerings in biology. It is the writer's contention that in a properly organized and properly taught course in biology there need be no necessity in the average high school for independent courses in the applied fields, but this means that the biology teacher must keep alert and informed on developments in the pertinent applied fields. *Seven Keys to Wildlife Conservation* is the first of a series to be published in THE AMERICAN BIOLOGY TEACHER, dealing with conservation problems as they bear on the obligations of a high school biology teacher. This unit concerns itself with some aspects of wildlife conservation. The next number will deal with what the biology teachers should understand of soil conservation. These articles are prepared as an activity of the *Conservation Committee* of the National Association of Biology Teachers.

It is trite to suggest that unless we teach about conservation the world is going to the "bow-wows." I have yet to see one of those intellectual gems supposed to be surveys of opinion that did not give the study of conservation in biology a high point value and considerable priority over many other fields that are better established in biology courses generally. And yet we have not yet begun to accomplish what we must accomplish. We complete a war loan, pay an income tax, or give our energies to a "drive" only to waken the next morning and learn that we must begin immediately to make a bigger loan, pay a larger tax, or work harder than ever on another campaign. The situation in conservation education is somewhat comparable.

Now that we walk to work or the movies or go without the meat and butter which formerly were ours when we were able to pay for them, we are getting a practical lesson in what it means to go without resources that were formerly abundant. We know rather definitely what many of our high school boys will be doing in the next year or two and that they will have to be more independent than was the NYA generation. Can biology teachers afford to continue offering just the same old stuff about *Spirogyra*, endocrine glands, and genes or should they strip off some of the dignified academic robes that have settled on these subjects and give a more functional offering to youths who may see more of life in the next twelve months than their teachers have seen in the last twelve years?

In the January, 1943, issue of this journal, I submitted a viewpoint on how the war might hit what I called *Succotash Biology*. Many of the ideas suggested there have since been established

as a part of the military training of our fighting men and many of those ideas fit into the picture of conservation education in peace or in war. We might in this article be a college professor and outline the relative merits of attaining what we need in conservation by legislating, financing, administering, organizing, educating or just trusting in God and doing nothing. We have had legislation and we will have more, but that is not enough. We have had generous financing by the *Wildlife Federation* project, but the results were neither nappy nor effective. We have organized people in clubs from one end of the country to the other. We have put stereotyped chapters about the dodo, the whale and the vanishing buffalo in our textbooks, and neither teachers nor pupils have enthused about conservation problems that were remote in time and place. Too many have adopted the philosophy of trusting in God and doing nothing just as too many untrained in science have attempted to speak authoritatively in a field in which they have little understanding. Just what are some of the fundamental things about wildlife conservation which any biology teacher can and should know and teach? We can all accept the idea that wildlife has a place in the general economy of our lives. We know that to some extent it may be considered as a crop in which a surplus may be harvested and should be harvested if we can agree as to what a reasonable surplus is. We know that there are certain attractive professional features that will be important in the postwar world where wildlife will be managed more than has been the case in the past. What can we do about this?

It is hoped that the Conservation Series will help teachers of high school biology to give their pupils some of the elements of a sound understanding of this fundamental and important problem.

E. Laurence Palmer,
Chairman, Conservation Committee

Papuan Notes

PRIVATE MORRISON A. RUDNER
United States Army

The Jungle

Despite the intense struggle for existence an abundance of species thrives in the tropical rain-forests of Papua. The fauna is almost entirely disassociated from that of Australia and in most cases from the animals of the islands to the North also. It is more closely related to Indian species. However, an area of about thirty square miles around Port Moresby is completely atypical and should be excluded from the above considerations. This small patch looked like northern Australian bush. It is relatively open, consisting of many small trees of about a six-inch average diameter. Northward the country changes from hilly to the precipitous Pre-Cambrian Owen Stanley Range. One peak is sixteen thousand feet above the sea. Occasionally the solid matting of green tree tops over the jungle is broken by a banana or coconut plantation, or, as one gets closer to the northern shore, by patches of seven-foot-high Kunai grass.

One feels pretty small and insignifi-

cant before the jungle. Mangroves of five-foot diameter covered with vines, and with wide-ribbed bases were predominant. We used the liana vines, as the boongs (natives) did, to bind together rude shelter and for other rope purposes. Many balsa trees furnished us light building material. What sunlight penetrated the tree tops was caught by the leaves of thick underbrush. A coat of thick decaying humus usually covered the perpetually damp ground. This hot dampness was all prevailing. Rotting occurred at a very rapid rate. The slightest skin abrasion or cut festered. Corpses became pretty rich in a few hours. Water was always obtainable but had to be chlorinated. Clothing took several days to dry enough to wear. Usually a black rot appeared on it.

Animal Life

Besides the intense distribution of flora the jungle is remarkable for the animal life it supports. However, I shall only discuss those I have personally observed. We were most painfully aware of two small but potent animals—mosquitoes and chiggers. This is truly the Age of Insects.

Many varieties of Anopheles as well as Aëdes mosquitoes filled the air. If one relaxed anti-mosquito measures he would almost certainly get malaria or dengue fever. With malaria, I found, a bit of mental depression followed by general weakness, diarrhea, and a fever of 103° F. are among the first symptoms. The first night severe chills and fever, accompanied by painful intestinal convulsions, occurred. A sleeping potion plus six or eight other pills brought troubled sleep after a few hours. Four days later the symptoms were gone.

Chiggers infested the Kunai grass. They attached themselves in pores and cause small blisters which later burst, producing festering sores. Most of these would rot away the skin, leaving a red scar a quarter of an inch across. The lower legs and feet were especially affected.

An assortment of other animals also shared the jungle with us. Among the Orthoptera (grasshoppers, etc.) I found Spiny Phasma or "Ogai," *Eurycantha horrida*, about ten inches long. My attempt to collect it was spoiled one night by a rat, or something, which ate it. Hemiptera were very noisily represented by cicadas. About sundown the shrill whirr was most annoying, especially when one got in the focus of their sound. Flying foxes, among them *Pteropus conspicillatus*, produced an eerie shuffling of their wings and their typical hissing call. Many six-inch Myriopoda (centipedes and millipedes) were present. Perhaps the strangest article I saw was a black fish line which was draped on a bush. It turned out to be a worm about four feet long. What the men thought to be a large ant really was a tree-dwelling tiger beetle, *Tricondyla aptera*. Myriads of fireflies belonging to the Lampyridae were also present. One green glow turned out to be a phosphorescent fungus, however.

Most of the birds were very elusive due to the poor visibility. A couple of very large parrots were to be seen near the tops of the larger trees. One was pure white while the other was a dark green with dark red wings. Large goose-like birds would pass at great heights. Several birds I saw looked almost like pterodactyls. Perhaps my imagination was working overtime, though.

Lepidoptera (butterflies and moths) attracted the soldiers more than did any other kind of insect. We used mosquito netting to catch our butterflies. About two per cent of the men I knew made collections. We would use cardboard and

cigarette pack cellophanes held together with adhesive tape to protect the specimens. Due to the extreme dampness mine are very moldy now. An iridescent blue and black swallowtail butterfly was the most sought after. It usually stayed high but sometimes came down to a stream bank or the blossoms of paw-paw trees.

Another high-flyer was the beautiful male bird-wing butterfly, *Papilio priamus poseridon*. It could be seen hovering just off a high leaf whereon the drab brown female sat. Birdwings have ovate anterior wings which makes them much wider than they are high. The specimens I have are about five inches across. Velvet black wings are broadly barred with a kelly-green color which appears gold when viewed from another angle. Some of the largest butterflies in the world belong to this sub-genus of Papiliotoides.

Parallel evolution seems to have occurred in two other Lepidoptera I have in my collection. Both are a hairy black and iridescent silvery blue-gold fringed in silver. One is a butterfly, *Alcides orontes*, while the other is a moth, *Papilio lagliazei*.

We also caught a very appropriate red, white and blue butterfly. A great number of Lepidoptera were simply white with black markings. My collection consisted of only nineteen different specimens. However, an Aussie dentist had a very fine collection of over fifty. "New Guinea probably has a greater variety of butterflies than any area of equal size in the world" according to Waterhouse in the AUSTRALIAN MUSEUM MAGAZINE of March 1943.

THE NATIVES

Even the natives hated the Japs. Crews of boongs gave us every assistance they were capable of giving. Missionaries had Christianized the younger fuzzy-wuzzies and taught them English. Many such boys were "tabados" or boss-boys. We would often hear the work crews singing. They were especially musical while working in the rain. Perhaps the water soothed their diseased skin. We were greeted with salutes or friendly shouts as we passed. Although boongs exhibit division of labor in building their native houses their work for us was inefficient. However, they were very willing and could carry astounding weights.

This is the way the boongs lived in their own villages: All buildings were on poles about five feet up. The house itself was generally about ten by twelve by four feet high. It was made of a vine-bound frame of poles upon which woven palm leaves were affixed. Women did the work. Taro, bananas, squashes, paw-paws and oranges were grown. I saw two very pretty types of flowering Leguminoseae near one village. Some boongs were indentured to work the coffee, coconut and other plantations before the present war. Such natives were treated to a life of affluence upon their return to their villages with the few pounds they earned. Three or four pounds was sufficient to buy a wife, some pigs, and so forth. Those native grown paw-paws were very like cantaloupe and were better than the Aussie-grown variety. Boong men use outrigger "Lakatois" for fishing and water transport. Most of these Melanesians were very muscular but were afflicted with ringworms and other skin diseases. Men wore loincloths of beaten tree bark with patterns dyed upon them. Wooden combs or occasionally bits of bright paper such as from a cigarette carton were worn in their high bushy

hair. A flower in a man's hair signified something in their marriage services. Each different tribe had its own style of ear lobe slits and colored rings. Women wore skirts of cloth or grass and were very unattractive. These Mary's would suckle their pickanins and pigs at the same time. Often when a boy came to trade he would be followed by a Mary carrying a woven bag suspended from her forehead and slung across her back. From it she would spread bananas, paw-paws or squashes at our feet. Then the man would say "bully beef." When he got the right amount it would be "okay." They even liked hardtack.

A few years ago, before the inter-tribal wars were put down, the hill tribes used to practice cannibalism and head shrinking. These two practices were in reality homage to the bravery of the dead foe and incidentally an expression of their own ego. When at night their eerie drumming and chanting came floating over the still air we would remember and be glad the boongs were on our side.

I was especially interested in the children. The "monkies" and younger "boys" were very friendly, with all the curiosity of children. Once a couple, about fifteen years old, danced a peace dance for us and later sang "Good Night Ladies." The words were quite clear, too. As a child grows he becomes in turn a "pickanin," a "monkey" and from nine or ten years of age until death, a "boy." Most pickanins and monkies had spindly arms and legs. Often the abdomen was very distended. Such enlargement was probably due to constipation or enlarged spleens from malaria. However, most natives seemed to be immune to active malaria.

Five men put on an interesting dance to show their friendship for us. They had decorated their entire bodies with patterns of iron oxide paint. Blossoms and white parrot feathers were stuck in their loin clothes, bushy hair, and woven grass arm and leg bands. All had their bead tribal mark around their slit ear-lobes. The dance itself was nothing but a rather slow stamp accompanied by their chanting and the beat of hour-glass-shaped drums which they carried. I detected four distinct rhythms. Their reward of mouldy cigarettes pleased them immensely.

Betel Chewing

Much has been written about betel-nut chewing. It is not romantic, but just another way humans abuse their health. A few older blacks who are so addicted gather the areca palm nuts and powder them between stones. To the powder is added lime juice, for which they have traded. The resulting dry mixture is put in a gourd with a long wooden stopper-applicator in one end. When placed in the mouth it becomes gum-like and forms a dark red coating on the teeth. A bright red color is given the gums. The addict we talked to seemed a little dazed, although I believe a tolerance for betel-nut is built up. This method of using betel-nut is to be compared to that of Malay and East Indies in which the nut of *Areca catechu* is placed along with a bit of lime within the betal leaf, *Ciper betle*, to form a hot-tasting pellet.

Several writers have called New Guinea a biologist's paradise. Strange and unusual plants and animals are there for the collector, but it surely is no paradise at present. The country has vast potentialities for colonization. I, therefore, believe the next ten years will produce a great change. We shall hear a lot more of New Guinea.

CHICAGO MEETING

The Representative Assembly, Editorial Board and Executive Board of *The National Association of Biology Teachers* met in Chicago, Saturday, November 27. Twenty-one attended the meetings, luncheon or dinner. It was regretted that so few affiliated local organizations were represented.

The report by G. W. Jeffers made those in attendance aware of the need for a paid secretary. This work is overwhelming for anyone to attempt as a secondary task; no one under such circumstances could do entire justice to it. Dr. Jeffers, taking over the duties in July, has done an excellent piece of work. His treasurer's report seemed none too bright at the moment, but was encouraging from the standpoint that it showed the organization to be "on the up." With further revenue from increased membership and with the sale of additional advertising for the journal, the Association can be out of the red and have money in the bank. Since it is necessary for the Association to be on a firm financial basis, it is hoped that all existing members will combine their efforts in seeing to it that the membership is increased.

Through the untiring effort of Marie Knauz, membership chairman, and the cooperation of the entire committee, membership in the Association is increasing daily, with a total of something over 1300 paid up to date. Miss Knauz's entire report pointed to the need for constantly reminding biology teachers that their best efforts are necessary in the matter of membership. The Association has something to give its members, but in turn, in addition to annual dues, they owe something, call it allegiance, or what you will. The committee is now made up of 55 willing workers representing the 48 States, Alaska, the Canal Zone, Hawaii, Mexico, Porto Rico and Canada. Miss Knauz's report was read at the meeting by President Russell.

Charles B. Price, Managing Editor, in the absence of Editor-in-chief Breukelman, previewed the 1944 outlook for THE AMERICAN BIOLOGY TEACHER, as compiled by the editor. Elmo Stevenson, of Corvallis, Oregon, was elected to the board as an associate editor. Several special issues are being prepared by committees and will be presented in early numbers. Mr. Price reported that last year all money for advertising was received, although there is some outstanding for ads sold in previous years. Several members in various parts of the country have accepted the task of helping to increase our advertising.

At the luncheon meeting, Dr. Carroll L. Birch spoke on her personal experiences in the study and practice of tropical medicine. She discussed her recent trip to Central and South America, where she had been sent to gain some practical experience for the instruction of medical students in this important branch. Those who heard Dr. Birch shared a rare treat.

The meeting renewed within the members present the desire to develop the association until it becomes one of the most vital organizations of its kind in the country. So vital, in fact, that all who teach biology will be eager to be members. Those present pledged themselves to these goals:

1. To exert every effort to increase the membership in *The National Association of Biology Teachers* to reach or surpass the three thousand goal.

2. To get before biology teachers, through THE AMERICAN BIOLOGY TEACHER, material that is timely, vital and informative, and meets the actual needs of teachers in service.

3. To put into the hands of each member annually an accurate, itemized financial statement of the organization.

4. To stimulate members to feel their responsibility to the Association and thus help to make it the powerful organization we feel it should be.

5. To renew the annual national and regional meetings as soon as possible without interfering with travel regulations.

HELEN TROWBRIDGE
President-elect

Editor's note: Space was reserved in the page proof for this brief note on the Chicago meeting. A number of other items, together with details of some of the items mentioned, will be reported in later issues of the journal.

FROM THE SECRETARY

In order to expedite mail delivery the Post Office Department has requested that city addresses include a postal zone number.

Whenever a member sends in his zone number a record is made of it, but quite a number fail to do so. If things ease up any during the winter we hope to have new stencils made for our entire mailing list. Hence you will be doing us a favor if you will drop us a card stating your correct postal zone number.

While you are doing it, why not at the same time make any necessary corrections to your name and address as they appear on your magazine wrapper. In a number of instances I have discovered injustices to people's names, and there must be others. To avoid such errors in transcribing, please print your name and address clearly and, in requesting changes of address, be sure to give both old and new addresses.

A certain number of new subscriptions are coming in every day, but we cannot send these names to the publisher each day. Publishers, like the rest of us, are hard pressed these days and if we sent in names in driblets there is a good chance that some might get lost. The results is that new subscribers do not always get their first magazine as soon as they think they should. All I ask is that you be patient. Possibly you will receive both the October and November issues at the same time; you might even receive the November issue before the October. However, don't hesitate to write me if your magazine does not show up after a reasonable time has elapsed. Extra copies are kept on hand for just such cases and once the machinery has been set up there should be no further trouble. Besides, I'm new at the game, and I still have to teach for a living.

G. W. Jeffers

FORMULAS FOR BIOLOGICAL SCIENCE

Bleaching Solutions

For bleaching bones and general skeletal material, heavily pigmented organisms for transparent mounts, etc.

A

Chloride of lime	1 pound
Sodium bicarbonate (baking soda)	3 pounds
Water	1 gallon

For bones; add soda to water, boil, cool and add chloride of lime, store in tightly stoppered bottle, preferably in a cool dark place.

B

Hydrogen peroxide; commercial solution in 10 to 25% solution; very good for small bones, also for worms, insects, etc., that must be bleached before being mounted on slides.

C

Commercial bleaches, like *Chlorox, Dag, Purex,* etc., in strengths ranging from those recommended for textiles to 4 times this strength are used for bleaching large bones, skulls, etc.

Embalming Fluids

Many different solutions are used for embalming specimens for dissection; most of them consist of formaldehyde, phenol (carbolic acid) and glycerin, sometimes with the addition of alcohol and other chemicals in varying proportions. Here are three that are in common use:

A

Formalin (40% solution)	20 cc.
Phenol (carbolic acid), liquid	40 cc.
Glycerin	90 cc.
Water, to make a total of	1000 cc.

B

Formalin	20 cc.
Phenol	20 cc.
Glycerin	80 cc.
Alcohol, 95% ethyl (grain)	200 cc.
Water, to make a total of	1000 cc.

C

Formalin	200 cc.
Phenol	50 cc.
Glycerin	200 cc.
Salicylic acid	40 grams.
Borax	40 grams.
Water, to make a total of	1000 cc.

In the above formulas, if phenol is available only in the crystal form, use 0.8 gram of crystals for each cubic centimeter of the liquid form.

For moistening embalmed specimens while in use, the following fluid has proved satisfactory. It may be made without the glycerin, but is then not so effective in keeping the tissues pliable, and may be irritating to the skin of the student.

Water	1000 cc.
Glycerin	200 cc.
Phenol	40 cc.

CONSERVATION UNITS

This issue contains the first of a projected series of conservation units. Each unit will deal rather extensively with one phase of conservation, so selected by the Conservation Committee as to present a coordinated whole that will be of value to the biology teacher who is interested in making as many applications as possible to the important science of saving our natural resources. The units will be of uniform size, printed on the center eight pages of the magazine. This will permit removal without disturbing the rest of the issue. The successive units can then be combined to make a manual on conservation in its biological and teaching aspects. It is possible that the board may make arrangements to have the entire series reprinted, when complete, in a single booklet.

BIOLOGY TEACHERS' CLUB OF SOUTHWESTERN PENNSYLVANIA

We have just received from the secretary, Miss Janette Dickson, Avalon, Pa., a copy of the 1943–44 yearbook of the Biology Teachers' Club of Southwestern Pennsylvania. It is an attractive 16-page booklet listing the officers, committees, monthly programs, affiliations, names and addresses of members. In the membership list those who are in the armed forces, and those who are members of The National Association of Biology Teachers, are separately designated. The officers of the Club are as follows: *President*, Elizabeth McClelland; *First Vice-President*, Nelle McLaughlin; *Second Vice-President*, Carsten Ahrena; *Secretary*, Janette Dickson; *Treasurer*, Elmer Thumm. It is of interest to note that Miss Marie Knauz of this club is the Chairman of the National Membership Committee.

The editor would appreciate receiving yearbooks, programs or other literature from all the affiliated local associations.

COMING SOON

Next month: the *Ornithology Issue* will be ready, packed full of information on birds and bird study, teaching aids, field trips, and the like.

The Special Issue on *Gardening* will probably appear in February, according to information from Mr. M. C. Lichtenwalter, chairman in charge.

The March number will present the second unit in the conservation series, an article on laboratory biology for wartime, and a contribution on teaching aids.

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GEORGE W. JEFFERS, Secretary-Treasurer,
State Teachers College, Farmville, Virginia. ☐ RENEWAL

I hereby apply for membership in The National Association of Biology Teachers and enclose $1.50 as my annual membership dues $1.20 of which is for a year's subscription to The American Biology Teacher. (Subscription may not be had separately)

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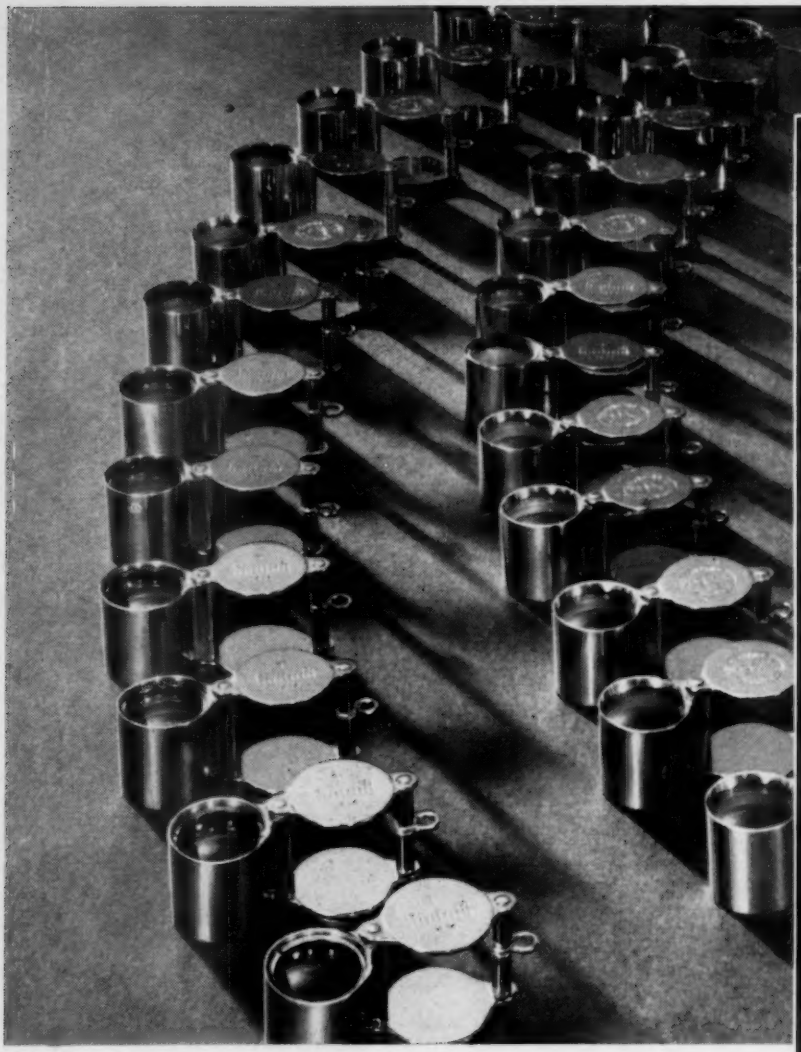
Biological Abstracts is published in seven low priced sections, as well as the complete edition, so that the biological literature may be available to all individual biologists. Section A, which includes General Biology, Biography-History, Bibliography, Evolution, Cytology, Genetics, Biometry and Ecology, is only $4 per volume (Foreign, $4.50). Ask for a sample copy.

BIOLOGICAL ABSTRACTS
University of Pennsylvania
Philadelphia, Pa.



Off to War...

These tiny but essential tools of war are Spencer Triple Aplanats, hand magnifiers, designed to give a large flat brilliantly defined field. Three precision lens elements cemented together correct spherical and chromatic aberrations.

Like Spencer Microscopes and other scientific instruments, Triple Aplanats are serving a wide range of uses including mosquito control, instrument examination and repair, clinical use in first aid stations and in base hospitals—wherever, in fact, the eye needs simple aid in examining details magnified from 6X to 15X.

Optical instruments are so vital to war and public health that the nation's needs absorb practically all of Spencer's greatly increased production.

Spencer LENS COMPANY
BUFFALO, NEW YORK
SCIENTIFIC INSTRUMENT DIVISION OF
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